EMBRYOLOGY.[1]

Some Activities of Living Eggs.—R. V. Erlanger[2] has published a brief account of the fertilization and the first cleavage stages of the eggs of several small Nematodes found in decaying earthworms; chiefly *Rhabdites dolichura* and *R. pellio.*

Some of the phenomena seen in the living eggs seem of special interest as adding to our knowledge of the amœboid power of egg protoplasm and at the same time furnish a welcome supplement to the results obtained upon the same and other nematode eggs by aid of reagents.

The sperm removed from the receptacle exhibits active amœboid movements at its conical end—the pseudopodia arise from folds that branch and anastomose and are capable of sudden, sharp bending movements at the free ends.

The egg shows active streaming currents in the protoplasm and amœboid movements at the end where the polar bodies are forming.

The egg nucleus moves rapidly towards the centre of the egg, apparently owing to the energetic streaming movements of the egg protoplasm, seen chiefly at the polar body end of the egg. This same end shows marked amœboid changes of outline that result in a deep furrow marking off from the larger end with the sperm nucleus a smaller blastomere-like end of the egg with the egg nucleus. The movement of the egg nucleus continues till it reaches the sperm nucleus lying at the pole opposite to the polar bodies.

A centrosphere appears and divides to form a spindle. The two nuclei coming together are flattened against one another and look like vesicles, each with a nucleolus. The spindle lies in the plane between the two nuclei and accompanies them as they slowly move toward the centre of the egg; the migration is accompanied by slow streaming throughout the entire egg and an obliteration of the external furrow that had marked off the egg into blastomere-like portions. In this migration toward the centre, the two nuclei stagger and turn somewhat, without losing their mutual relations of position.

At the centre of the egg the spindle assumes a position to coincide with the long axis of the egg and the two nuclei elongate parallel to it; astral rays become prominent from the ends of the spindle. The cen-

[1] Edited by E. A. Andrews, Baltimore, Md., to whom abstracts, reviews and preliminary notes may be sent.

[2] Biologisches Centralblatt, XVII. No. 4, p. 152–160 and No. 9, p. 339–346.

trospheres swell and a swelling is conspicuous at the equator of the spindle (where reagents show the equatorial plate dividing) while the astral rays become very long aad *curved,* convex towards the egg surface.

The egg protoplasm now begins to move actively again in streams that set the spindle into slow pendulum-like movements. This streaming takes place alternately in each end of the egg and consists of movements from the pole toward the equator.

The cleavage plane appears suddenly as a groove on the surface of the egg at one side, and the internal streaming of protoplasm coming down from the pole towards this equatorial groove *turns inwards and then back towards the pole.* The same takes place on the opposite side of the egg, and the cleavage plane instantly cuts across through the egg.

Amongst unusual cases the author mentions the interesting fact that the movement of the protoplasm may temporarily bend the first cleavage spindle so much that its "fibres" become wave-like, while these same movements may make the astral rays twist into spirals, as seen by Mark in Limax. External pressure exerted on the eggs may bring about the same bending of spindle and rays. The author concludes that all the egg—spindle and astral rays included—is always plastic and liquid, though the material of the spindle of the rays is more viscid than the rest.

After the first division the larger of the two cells soon shows protoplasmic streamings again, and curious ridge-like pseudopodia rise up from its surface near the edge of the cleavage plane. Blunt pseudopodia may form on other parts of the surface, but the amœboid movements of the first two blastomeres are not as pronounced as those of the fertilized egg.

In the second division each cell shows streaming movements from the poles to the equator, and before the cleavage plane appears the spindle is seen to vibrate from side to side.

When the four cells are forming they glide over one another into a new arrangement, and in so doing they are much distorted by pressure—even the spindle within them being distorted.

The paper contains many other interesting facts regarding the cleavage phenomena, both as seen in living and in preserved eggs, but we will only note certain facts that speak for the view of Bütschli as to the vesicular or foam-like structure of protoplasm. Besides all the above facts that show the liquid and viscid state of even the most firm parts of the egg—the fibres—the author sees an appearance of vesiculation at

times in the centrosomes, and the chromosomes may appear rather as hollow vesicles than as solid bodies. The general protoplasm, filled with yolk, showed in some cases a very fine net-alveolar structure in places. On the surface the alveolar layer of Bütschli was always present, and just after the cleavage a very plain cell-plate of Carnoy is regarded and figured by the author as merely the appressed alveolar layers of the two adjacent cells.

PSYCHOLOGY.[1]

Physiological Effects of Mental Work.—Within the present decade the relation between mental work and the bodily processes has been the subject of much study. Interest in the problem as a field for practical inquiry was first aroused by a paper on the fatigue resulting from intellectual work, published by Sikorsky in the *Annales d'hygiène publique* for 1879. He was followed more than ten years later by Burgerstein, Laser, Griesbach and others. In these investigations the method used was that of testing school children in classes. Various problems and exercises were set before them, during and after the school session, and the percentage of errors committed in the operations was taken as measure of the fatigue due to mental work. While some individual errors might be due to other causes, the average percentage of the entire class seemed a fair test of this factor. The latest instances of this method are the investigations of Friedrich and Ebbinghaus described in the May number of the NATURALIST. At about the same time Mosso and his pupils took up the question from another side. They instituted a series of laboratory investigations upon single individuals by means of the ergograph, with a view to determining the fatigue due to steady intellectual, as well as physical work. Kraepelin and his pupils meanwhile undertook the same problem, varying it with tests of the influence of various stimulants and narcotics on the capacity for mental work. They made use of the reaction time method, as well as the percentage of errors. More recently, Binet and his pupils have taken up the subject from a different standpoint, their object being to measure the effect of mental stimulation and mental effort on the bodily processes of breathing, heart action, etc. Several other investi-

[1] Edited by Howard C. Warren, Princeton University, Princeton, N. J.